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Abstract

This report updates the description of the OAN facilities as an IVS network station. The new 40-m radiotelescope has performed geodetic VLBI observations regularly since September 2008. Commissioning continues in particular for short wavelengths (3 mm). Yebes will become one of the new Space Geodynamics Stations in the RAEGE project, with the construction of a new radiotelescope of VLBI2010 specifications and an SLR facility in the near future.

1. General Information: the IGN Facilities at Yebes

The Yebes radiotelescopes (the new 40-m and the old 14-m which was an IVS network station since 2003 and is now being refurbished for VSOP-2) are located at the currently named "Technological Development Center" (CDT-Yebes), a department of the Instituto Geográfico Nacional (IGN, Ministerio de Fomento) together with the National Astronomical Observatory (OAN).

Yebes CDT is also the reference station for the Spanish GPS network and holds new facilities for gravimetry. As explained later in detail, the RAEGE project, which will build four Fundamental Geodynamical stations, will soon provide a new VLBI2010-type antenna in Yebes, together with an SLR system in a new control building.

2. IGN-OAN Staff Working on VLBI Projects

Table 1 lists the OAN staff who are involved in geodetic VLBI studies and operations. The VLBI activities are also supported by other staff such as receiver engineers, computer managers, secretaries, and students. Hiring of dedicated telescope operators is completed and available in Yebes in the first quarter of 2010.

Table 1. Staff in the OAN VLBI group (Email: **vlbitech@oan.es**).

Name	Background	Role	Address*
Francisco Colomer	Astronomer	VLBI Project coordinator	OAM, IGN
Susana García-Espada	Engineer	Ph.D. student	CAY
Jesús Gómez–González	Astronomer	Deputy Director for Astronomy, Geodesy and Geophysics	IGN
José Antonio López–Fdez	Engineer	CAY site manager	CAY
Pablo de Vicente	Astronomer	VLBI Technical coordinator	CAY

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OAM: Observatorio Astronómico de Madrid. Calle Alfonso XII, 3. E–28014 Madrid, Spain.
CAY: Centro Astronómico de Yebes. Apartado 148, E–19080 Guadalajara, Spain.
IGN: Instituto Geográfico Nacional. Calle General Ibañez de Ibero 3, E–28003 Madrid, Spain.

Table 2. Characteristics of the Yebes 40-m geodetic VLBI station.

Parameter	Value	DAR	VLBA5 (14) + VSI-C
Diameter	40 meter	Recorder	Mark 5B
Receivers	2 - 115 GHz	H-maser	T4-Science iMaser 3000
S/X T_{sys}	180/60 K	GPS	TrueTime XL-DC
S/X SEFD	800/200 Jy	Weather station	SEAC-EMC

3. Status of Other Geodetic VLBI Activities at OAN

The 40-m radiotelescope has participated regularly in IVS geodetic VLBI campaigns, except during the summer due to a failure of the H-maser. In total, 16 campaigns were observed, and 3 were lost because of this problem.

The connection of Yebes to GÉANT at 1 Gbps, thanks to the EC project EXPReS, has been fully operational since April 2009.

A new Hydrogen maser has been purchased, to replace the Russian KVART-73 maser which failed in 2009 after 13 years of successful operation.

An absolute gravimeter is now permanently placed at the new building in Yebes. A superconducting gravimeter is expected in April 2010.

Figure 1. Absolute gravimeter at the new building in Yebes.

The new $\lambda = 3\,\mathrm{mm}$ receiver was installed at the 40-m cabin, and first light was obtained in December 2009. This receiver will be mostly used for single dish and VLBI astronomical studies.

Cooperation with the geodesy group at Onsala Space Observatory in Sweden progresses by modeling the tropospheric effect caused by neutral atmosphere using the HIRLAM 3D-VAR numerical weather prediction model, where a direct improved mapping function is calculated using raytracing. Preliminary results will be presented at the IVS 2010 General Meeting in Hobart (Australia).

4. Future Plans: Project RAEGE

IGN intends to construct a network of four new Fundamental Geodynamical Stations in Spain and Portugal (see Figure 1). This project, named *RAEGE* (after "**R**ed **A**tlántica de **E**staciones **G**eodinámicas y **E**spaciales"), consists of the erection in Yebes (1), Canary Islands (1), and Azores Islands (2), of one radiotelescope of VLBI2010 class (i.e. of 12-m diameter, high slew rate, capable of operating in the 2-18 GHz bands), a permanent GNSS receiver, a superconducting gravimeter, and (at least in Yebes) an SLR station. The construction of the first three stations (in Yebes, Gran Canaria, and Azores-Santa María) will start in 2010.

Figure 2. Location of the new stations in the RAEGE project.

References

[1] Barbas L., Bolaño R., de Vicente P. "Java Field System Log File Client". Informe Técnico OAN 2009-8 (see `http://www1.oan.es/informes/archivos/IT-OAN-2009-7.pdf`).

[2] de Vicente, P. "How to run a VLBI observation with the 40m radiotelescope". Informe Técnico OAN 2009-7 (see `http://www1.oan.es/informes/archivos/IT-OAN-2009-7.pdf`).

[3] García-Espada S., Colomer F., Haas R. "Simulations of Different Antenna Velocities in VLBI Networks". 2009. Proceedings of the 19th European VLBI for Geodesy and Astrometry Working Meeting, 24-25 March 2009, Bordeaux. G. Bourda, P. Charlot, A. Collioud (Eds), p. 169-172.

[4] Gómez-González J., Colomer F., López-Fernández J.A. "An Atlantic Network of Geodynamical and Space Stations (Project RAEGE)". 2009. Proceedings of the 19th European VLBI for Geodesy and Astrometry Working Meeting, 24-25 March 2009, Bordeaux. p. 133.

Figure 3. Elements of the future RAEGE station in Yebes (Guadalajara, Spain).